



Non-invasive Estimation of Metabolic Uptake Rate of Glucose using F18-FDG PET and Linear Transformation of Outputs

Christensen, Anders Nymark; Reichkender, M.; Auerback, P.; Larsen, Rasmus; Nielsen, H.; Ploug, T.; Stallknecht, B.; Højgaard, L.; Holm, S.

Publication date:
2012

[Link back to DTU Orbit](#)

Citation (APA):

Christensen, A. N., Reichkender, M., Auerback, P., Larsen, R., Nielsen, H., Ploug, T., Stallknecht, B., Højgaard, L., & Holm, S. (2012). *Non-invasive Estimation of Metabolic Uptake Rate of Glucose using F18-FDG PET and Linear Transformation of Outputs*. Abstract from 25th Annual EANM Congress, Milan, Italy.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Poster Walk: Physics & Instrumentation & Data Analysis

European Association of Nuclear Medicine, 25th congress, 2012 in Milan

Title: Non-invasive Estimation of Metabolic Uptake Rate of Glucose using F18-FDG PET and Linear Transformation of Outputs

Authors: A. N. Christensen^{1,3}, M. Reichkender^{1,2}, P. Auerback², R. Larsen³, H. Nielsen⁴, T. Ploug², B. Stallknecht², L. Højgaard¹, S. Holm¹;

- 1Rigshospitalet—Clinical Physiology, Nuclear Medicine and PET, Copenhagen, DENMARK,
- 2Copenhagen University—Department of Biomedical Sciences, Copenhagen, DENMARK,
- 3Technical University of Denmark—Department of Informatics and Mathematical Modelling, Copenhagen, DENMARK,
- 4Rigshospitalet—Department of Anesthesiology, Copenhagen, DENMARK.

Abstract: For quantitative analysis and kinetic modeling of dynamic PET-data an input function is needed. Normally this is obtained by arterial blood sampling, potentially an unpleasant experience for the patient and laborious for the staff. Aim: To validate methods for determination of the metabolic uptake rate (K_m) of glucose from dynamic FDG-PET scans using Image Derived Input Functions (IDIF) without blood sampling. Method: We performed 24 dynamic FDG-PET scans of the thigh of 14 healthy young male volunteers during a hyperinsulinemic isoglycemic clamp. Ten of the subjects were scanned twice 11 weeks apart and all with concurrent Arterial Blood Sampling (ABS). We proceeded to evaluate different earlier proposed methods as well as several new ones based on Archetypal Analysis for generating IDIFs. Comparison of the methods was based on the sets of K_m -values generated for each scan from Patlak plots based on one common tissue curve against all the IDIFs. When compared to ABS K_m values, an underestimation was found for all methods. Using ordinary least squares estimation on the ABS K_m values vs. the IDIF K_m a calibration factor and term was identified for each method and used for transformation. The Mean Squared Error (MSE) was determined for the different methods before transformation, and estimated by N-fold cross validation and .632+ bootstrapping after transformation. Further, since ordinary least squares is an unbiased estimator we could use the estimated MSE to determine the standard deviation of the different unbiased methods after transformation using the relation $MSE(\theta) = \text{variance}(\theta) + \text{bias}(\theta)^2$. Results: All methods performed poorly before transformation, except one described by Backes et al.. After transformation all methods yields unbiased K_m based on the IDIF alone but have different standard deviations with the best method-Parker and Feng- at 0.0030 i. e. around 10 %. Conclusion: Based on this study, we can estimate the metabolic uptake rate of glucose with good accuracy and precision in similar future studies without blood sampling. Given the high variance of the femoral artery diameter in the material, the method should also be applicable to women and people of other ages, but used with caution in the elderly due to variance in intramuscular adipose distribution. If only K_m and no other kinetic parameters are needed, the described method with transformation of the results based on ordinary least squares, gives unbiased low variance results without arterial blood sampling and it has the potential for use in other regions of the body.